



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

knows his own mind. But the prettiest of all the exhibitions a gopher can make of himself, is when he frames his profile in the rim of his burrow. Not seldom, after running some little fellow to earth, have I stood still just by the hole, and confidently waited for his reappearance. Presently I hear a little scratching, perhaps a squeak, and then I see his head, turned roguishly to one side, to throw one bright black eye full upon me, as if to ask what manner of creature I may be to stand thus boldly at his door. He looks as if he would like to invite me in, and then laugh at me for being too big and too clumsy to enter.

A STATE SURVEY FOR MASSACHUSETTS.

BY PROF. N. S. SHALER.¹

WHILE Hayden with his score of coadjutors is skirmishing over the unexplored recesses of the West, reconnoitring an empire in a season, the surveyors of Great Britain are patiently unriddling their islands at a rate that will require a century for its completion.

It must not be supposed because these two kinds of workers differ so widely in their methods that either is mistaken. Each is doing legitimate work in its sphere, and each has its important scientific and economic results. Perhaps the best specimen of this system of reconnoissance work which has ever existed is now in operation in this country, under the charge of Dr. Hayden; other expeditionary surveys under the charge of Mr. Clarence King and Major Powell, have shared with Hayden the task of unravelling the complicated geology and topography of the vast area lying between the eastern and western borders of the Cordilleras of North America. The present system pursued by Hayden is admirably suited to secure the most rapid delineation of a country for correct sketch maps. A system of triangles is carried across country from mountain-top to mountain-top, so that a large number of positions are accurately determined. From good points of view the topographer delineates the intermediate country by the

¹ The following extracts are taken from an article in the "Atlantic Monthly" for March. We regret that we have not space to reprint the article entire, as it forms an admirable presentation of the subject of surveys in general.—EDS.

use of the theodolite; contour lines, or lines supposed to represent equal heights above a water level, are sketched in with some detail, so that the eye catches the true reliefs of the country. Along with these topographical parties go geologists and collectors of specimens, to illustrate the geology and biology of the country. This survey is carried on at such speed that in a season of four or five months a single party will work in several thousand square miles of territory and obtain a remarkably good idea of all its important features. Several of such parties together make up the expedition, and the reports set forth, with a fair accuracy, the topography, geology, zoölogy, botany, agricultural resources, and such information as can be gained concerning the climatology of the district surveyed. It is difficult to imagine a plan better calculated than this to accomplish the end in view, namely, to discover the general characters of an unexplored land, and to guide the coming immigrant in its development by the steady light of science.

The state of Massachusetts is a remarkably favorable state for illustrating the methods in which a survey should be conducted; not such a survey as a new Western State makes in order to get some idea of where its coal and iron lie, and the amount of its wealth, but a work intended to be the most exact and final work which it is possible to do on the earth's surface. When a government approaches so considerable an enterprise as this, and determines that it is to be done so as never to require, in our day at least, a reconstruction, all geologists will agree that the first thing is to secure the best map. Massachusetts has the good fortune to have her shore-belt map completely made by the Coast Survey; Cape Ann and Cape Cod and the bordering islands, making, together, about a tenth of the total area of the state, have all been done on the scale of one ten thousandth, or about six inches of map to the mile of distance. If it were practicable, this map should be continued on the same scale over the whole state, making, when finished, a record map about ninety feet long and fifty-four wide; on this scale every important detail could be truthfully laid down. This is the proper thing to do, and nothing but the cost of the work can be urged against it; on this plan the surveying and improvement of private grounds could always be accomplished, tax-levies made, in short, our civilization could be organized upon it. If something else less perfect must be done, it will be with the greatest regret that we turn to it from our ideal.

On this perfect system the topography alone would be likely to cost over half a million of dollars and pretty certain not to exceed three-quarters of a million, or about as much as one thousand feet of the Hoosac Tunnel. Who will say that Massachusetts cannot afford this sum for a perfect record of the theatre of her industries? If, however, it be thought that it is better to temporize with the matter, it will certainly be possible to get the most important results with a smaller original map — one twenty-five thousandth, or about two and a third inches to the mile, will answer for most of the great economic purposes of a survey; it will not, however, serve as a tax map or for the management of individual estates, and in time it would have to be done over on the larger scale. The dimensions of the original maps, it should be noted, is quite another matter from the size they have in their published form; from the original records reductions can be made to any scale.

When this topography is far enough advanced to give a basis for other work, the geology and biology should be taken in hand. Here we come upon a class of researches which require some special consideration. What should be the objects of this scientific work, and how are these objects to be attained? To answer these questions at length is to discuss all the methods and aims of science. There are some limitations, however, which are worthy of note. Any state, however small, furnishes problems organic and inorganic, which will require centuries for their complete discussion. As we do not propose that a survey shall take up at once all the problems of science, it becomes a nice matter to limit the work. In the geology this is comparatively easy; no amount of detail consistent with the condition of the science will be superfluous here; every stratigraphical question, every question in chemical geology, should be followed to its utmost point. Each region supplies the investigator with special problems which he knows whenever the general structure of a country is known; it is the special object of a reconnoissance to show what and where these problems are. Some of them are economical, have money in them; the others are economical too, in that higher sense which finds all truth profitable. Of those which connect themselves immediately with industry we may mention the following questions: (1) the distribution of water, its storage and quality; (2) the building-stones of the state; (3) the existence of deposits of coal in workable quantities; (4) the distribution of metals, the iron of the

western region, and the silver-bearing beds of the east; (5) the reclamation of marshes; (6) the retimbering of the exposed parts of the coast. Among the scientific problems, the state affords some matters of surpassing interest. Probably no other known fossils have so much value for the science of to-day as those wonderful footprints of the Connecticut Valley. They deserve years of study and the thorough investigation which can only be given by a careful re-survey of the whole region.

Among the many problems concerning the existing life of the state, it is difficult to give in a word the most important. A large part of the necessary work for the complete description of our animals and plants is already done, and needs but to be assembled and ordered. The state is already rich in investigators, and as soon as a survey begins, these will be increased; from their labors we may hope for a thorough study of the biology of Massachusetts. The state has already taken advanced ground concerning instruction in natural history. It will greatly aid the work of diffusing a knowledge of nature throughout the people, to have carefully edited catalogues of all the animals and plants existing within the state, with enough concerning their characters, habits, etc., to make the information of practical value to beginners. This work need be of very little expense to the survey; the state already has nearly a million of dollars invested in the Museum of Comparative Zoölogy, and in the work of cataloguing the animals this noble institution can make a substantial return through the students it has trained and the collections it has accumulated. Managed with discretion, this survey could not fail to bring about a great interest in science in our public schools of all grades. With good maps and good catalogues of the natural productions of a country, the teaching of natural science becomes possible to a degree that cannot be hoped for under other circumstances. This is to Massachusetts a matter of great importance; her real greatness has lain and always must lie in her power to produce men preëminently fitted for the work of their day. Other states can, almost without effort, beat her in the race for material greatness, strive as she may against it; but her intellectual lead, now so clearly established, may be maintained to the end if she but care to take the steps necessary to keep her energies bent towards this object. She must now foster science as she has established and fostered theology and general learning.